

REMARKS

Favorable reconsideration and allowance of the claims of the present application is respectfully requested. Applicants acknowledge, with thanks, the Examiner's indication in the Office Action dated July 12, 2004 that Claims 21-22 are allowable over the art of record. Although allowance of Claims 21-22 is indicated, applicants, at the present time, would like to obtain a patent including all the claims pending in the present application.

In the present Office Action, Claims 1-20 stand rejected over U.S. Patent No. 6,228,678 to Gilleo, et al ("Gilleo, et al.") in view of U.S. Patent No. 6,346,296 to McCarthy, et al. ("McCarthy, et al."). Applicants respectfully disagree with the Examiner's conclusion that the combination of Gilleo, et al. and McCarthy, et al. render Applicants' invention unpatentable and submit the following.

To establish a prima facie case of obviousness, under 35 U.S.C. §103, three criteria must be met. First there must be some suggestion or motivation, either in the references themselves or the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Third, the prior art reference (or references) combined must teach or suggest all of the claimed limitations. Finally, the teaching or suggestion to make the claimed combination and the reasonable expectation of success must be both found in the in the prior art and not based on applicants disclosure. *See Hodosh v. Block Drug Co., Inc.*, 786 F.2d 1136, 1143, 229 USPQ 182, 187 (Fed. Cir. 1986).

Applicants submit that the claims of the present application are not rendered obvious by the applied prior art, since neither of the applied references disclose each and every

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limitation of applicants' claimed method and there is no motivation to combine the applied references.

Gilleo, et al. do not teach or suggest forming a bilayer underfill, "comprising the steps of forming a first polymeric material on a surface of a semiconductor wafer having interconnect pads disposed thereon; patterning the first polymeric to provide openings that expose the interconnect pads; forming conductive bump material in the openings; *forming a second polymeric material that is partially cured to a B-stage state atop the first polymeric material and the conductive bump material*; dicing the semiconductor wafer into individual chips; and bonding at least one of said individual chips to an external substrate, wherein during such bonding the conductive bump material penetrates the second polymeric material and contacts a surface of the external substrate", as recited in Claim 1. "To establish a prima facie case of obviousness of a claimed invention all the claimed limitations must be taught or suggested by the prior art" *In re Wilson*, 424 F.2d 1382, 1385, 165 USPQ 44, 496 (CCPA 1970).

Gilleo, et al. fail to render applicants' claimed method unpatentable, under 35 U.S.C. §103(a), since Gilleo, et al. do not teach or suggest "*forming a second polymeric material that is partially cured to a B-stage state atop the first polymeric material and the conductive bump material*", as recited in Claim 1. Applicants observe, referring to Page 4 of the Final Rejection dated December 4, 2002, that the Examiner agreed that, "Gilleo fails to teach a partially cured second polymeric material over a first polymeric material and conductive bump material".

Applicants' further submit that Gilleo, et al. fail to teach or suggest partially curing the second polymeric material to a B-stage state. Curing a polymeric material to a B-stage

state requires advancing the reaction of a thermosetting polymer to below the gel point to which the material becomes insoluble. The gel point is the point at which cross-linking occurs. B-staging renders thermosetting materials non-tacky since it raises the glass transition temperature of the polymer to above room temperature. Tacky materials are soft at room temperature. In thermoplastics, this is not possible because thermoplastics do not react. Specifically, thermoplastics do not cross-link because all the reactions to the polymer backbone have concluded.

Gilleo, et al. do not teach or suggest partially curing the second polymeric layer to a B-stage state. Applicants observe that in one embodiment of Gilleo, et al. a first polymeric layer which includes a thermoplastic resin as the main component and a B-stage thermoset as a lesser component are used. Although Gilleo, et al. disclose that B-stage thermosets may be present in the first polymeric layer there is no teaching or suggestion of a B-stage thermoset being utilized in the second polymeric layer. Referring to Column 8, line 43-65, the second polymeric layer disclosed in Gilleo, et al. comprises a flux system including an epoxy resin. Applicants note, referring to Page 5 of the Final Rejection, dated September 24, 2003, that the Examiner agreed that Gilleo, et al. fail to teach that the second polymeric material is partially cured to a B-stage state, as recited in Claim 1.

Additionally, Gilleo, et al. disclose the use of thermoplastic polymers as the main component of the underfill. Specifically, Gilleo, et al. referring to Column 7, lines 29-31, disclose that their method eliminates the problems associated with thermoset underfills by incorporating thermoplastics. Therefore, Gilleo, et al. teach away from applicants' claimed invention because Gilleo, et al. favor thermoplastics that cannot be cured to a B-stage state.

Therefore, Gilleo, et al. fail to teach or suggest each and every limitation of applicants' claimed method, since Gilleo, et al. fail to teach or suggest *forming a second polymeric material that is partially cured to a B-stage state atop said first polymeric material and said conductive bump material.*

The applied secondary reference, McCarthy, et al., is directed to compositions and methods for improved packaging substrates for packaging of electronic components. In the prior art method, first and second precursors are provided having a backbone, and first and second ethynyl groups. In a next step, a crosslinker is provided having a first and a second reactive group. In a further step, the crosslinker, the precursors, and a solvent are applied to a surface. In a still further step, first and second ethynyl groups from first and second precursors are reacted with the first and second reactive groups of the crosslinker in a carbon-carbon bond formation reaction, respectively, thereby crosslinking the first backbone with the second backbone. In yet a further step, the solvent is removed. Applicants submit that McCarthy, et al. fail to teach each and every step of applicants' claimed method and are far removed from applicants' claimed invention, since McCarthy, et al. are not directed to underfills utilized in flip chip technology.

The §103 rejection also fails because there is no motivation in the applied references which suggests modifying the methods disclosed in Gilleo, et al. and McCarthy, et al. to include applicants' claimed method having the process step of forming a second polymeric material that is partially cured to a B-stage state atop the first polymeric material and the conductive bump material, as recited in Claim 1. This rejection is thus improper since the prior art does not suggest this drastic modification. The law requires that a prior art

reference provide some teaching, suggestion, or motivation to make the modification obvious.

To establish a *prima facie* case of obviousness, the Examiner must show "some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings of the references." *Fine*, 837 F.2d at 1074, 5 USPQ2d at 1598. There is no suggestion to combine, however, if a reference teaches away from its combination with another source. *See id.* at 1075, 5 USPQ2d at 1599. "A reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant . . . [or] if it suggests that the line of development flowing from the reference's disclosure is unlikely to be productive of the result sought by the applicant." *In re Gurley*, 27 F.3d 551, 553, 31 USPQ2d 1130, 1131 (Fed. Cir. 1994). If when combined, the references "would produce a seemingly inoperative device," then they teach away from their combination. *In re Sponnoble*, 405 F.2d 578, 587, 160 USPQ 237, 244 (CCPA 1969); see also *In re Gordon*, 733 F.2d 900, 902, 221 USPQ 1125, 1127 (Fed. Cir. 1984) (finding no suggestion to modify a prior art device where the modification would render the device inoperable for its intended purpose).

Here, there is no motivation provided in the disclosures of the applied prior art references, or otherwise of record, which would lead one skilled in the art to modify the methods of the applied references to include applicants' claimed sequence of processing steps recited in Claim 1. Applicants submit that one of ordinary skill in the art would not be motivated to combine Gilleo, et al. with McCarthy, et al., because the applied references

teach away from the Examiner's proposed combination. A prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention. *W.L. Gore and Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983).

Gilleo, et al. are concerned with reworking during chip mounting process steps and overcoming the disadvantages of thermoset underfills. Gilleo, et al. disclose, referring to Column 7, lines 29-35, that the problems associated with thermoset underfills can be overcome by incorporating a thermoplastic as a main constituent of the underfill. McCarthy, et al., disclose a thermosetting polymer having covalent crosslinks formed between adjacent molecular chains. McCarthy, et al. further disclose, referring to Column 3, lines 61-65, that "the term "crosslinker" refers to a molecule with at least two chemically reactive groups that are able to react with two precursors such that one precursor will be covalently bound to the first reactive group of the crosslink, and another precursor will be covalently bound to the second reactive group of the crosslinker." Therefore, since Gilleo, et al. teach that thermosetting underfills should be avoided for the purposes of reworking and McCarthy, et al. disclose that thermosetting polymers are preferred for highly stable packaging substrates, the applied references teach away from their combination.

Additionally, one of ordinary skill in the art reading the disclosure of Gilleo, et al. would conclude that incorporating a thermosetting material as a constituent of the underfill, as suggested by the Examiner, changes the principle of operation of the Gilleo, et al. method, since thermosetting materials impair reworking. If the proposed modification or combination of the prior art would change the principle of operation of the prior art

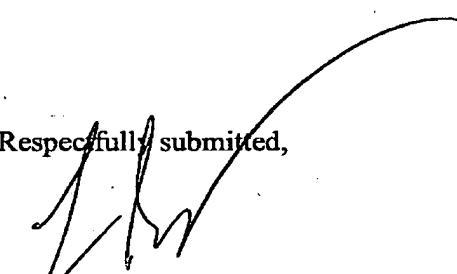
invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. *In re Ratti*, 270 F.2d 810, 123 USPQ 349 (CCPA 1959).

Therefore, one of ordinary skill in the art would not be motivated to combine McCarthy, et al. and Gilleo, et al. to produce applicants' claimed method.

In view of the above remarks, applicants respectfully submit that Claims 1-20 are patentable subject matter over the combined disclosures of Gilleo, et al. and McCarthy, et al.

Wherefore, reconsideration and allowance of all the pending claims of the present application is respectfully requested.

Respectfully submitted,


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